Title of the module	**NMR: physical basics and biomedical applications**		
Term / semester	Summer term / 2		
VAK-Number	Will be assigned centrally		
Credit points	6 ECTS		
Compulsory / elective course	Elective course		
Teaching methods	Method	SWS	CP
	Lecture Seminar Practical Course	2 (28 h) 1 (14 h) 1 (14 h)	3.0 1.8 1.2
Self studies	protocols 30 h preparation of the talk 30 h learning for the exam 40 h		
Module representative	PD Dr. C. Neumann-Haefelin		
Instructor	PD Dr. C. Neumann-Haefelin		
Examiner	PD Dr. C. Neumann-Haefelin		
Objectives	The module gives an introduction into the physical and mathematical basics of medical imaging and spectroscopy methods based on nuclear magnetic resonance (NMR). Additionally some (patho)-physiological aspects of different diseases were discussed in order to identify possible markers to detect these disorders using NMR.		
Content of teaching	*Topics of the lecture:* - NMR-Equipment - Principle of nuclear magnetic resonance - Basics of signal- and image formation - Relaxation - Intrinsic and extrinsic NMR contrasts - Basics of advanced NMR techniques (fast imaging, fMRI, …) - Pathophysiological aspects of metabolic & cardiovascular diseases, diseases of the central nervous system - Basic concepts of associated in-vivo models *Lab course:* Execution of NMR experiments to get a deeper understanding of the following NMR aspects and the ability to analyze / calculate NMR parameters - NMR contrasts, Relaxation times, Diffusion … - Relaxivity and contrast behavior of contrast agents - Artefacts		
Learning results	Fundamental and advanced knowledge in physical aspects of NMR imaging and spectroscopy including basics of the development of NMR methods and the analysis and understanding of detected images. Ability to develop / understand a strategy for in-vivo experiments based on given pathophysiology		
Control of learning progress	Oral participation, seminar talk, protocols and oral (or written) exam		
Grading	Each 25%		
Frequency	Every summer term		
Use in other study courses	The module is also open for diploma students of biology (examination subjects: biochemistry, molecular and cell biology) and chemistry (main focus biochemistry).		
Requirements	Successful participation in modules A and B		